FLIGHT
and The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (50 lines).

8-10, CORPORATION ST., COVENTRY.	GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2.	260, DEANSGATE, MANCHESTER, 3.	26B, RENFIELD ST., GLASGOW, C.2.
Telegrams: Autocar, Coventry. *Telephone:* Coventry 5210.	*Telegrams:* Autopress, Birmingham. *Telephone:* Midland 2971 (5 lines).	*Telegrams:* Iliffe, Manchester. *Telephone:* Blackfriars 4412.	*Telegrams:* Iliffe, Glasgow. *Telephone:* Central 4857.

SUBSCRIPTION RATES: Home and Canada: Year, £2 6 0. 6 months, £1 3 0. 3 months, 11s. 6d.
Other Countries: Year, £2 9 0. 6 months, £1 4 6. 3 months, 12s. 3d.

No. 1639. Vol. XXXVII. MAY 23, 1940 Thursdays, Price 9d.

The Outlook

The New Ministry

FOLLOWING closely upon the appointment of Sir Archibald Sinclair to the post of Secretary of State for Air comes the announcement of the establishment of a new Ministry, the Ministry for Aircraft Production, with Lord Beaverbrook as the first Minister.

The co-ordination of aircraft production is quite obviously a matter of the very greatest importance, but we find it a little difficult to see what Lord Beaverbrook can do. It is true that he has already announced that he wants garage mechanics to transfer to aircraft works as fitters, but that will not make a vast difference to our aircraft output. He has also announced some sort of an amalgamation between the Vickers-Armstrongs group and the Nuffield interests, with Mr. Westbrook as Director of the Aircraft Civil Repair Organisation, whatever that may mean.

From the fact that Labour is now represented in the Government, one may assume that everything possible will be done to see that the workers of the country are given the opportunity to give of their best in the common cause. The appointment of Lord Beaverbrook cannot, one would imagine, add greatly to the effectiveness of our productive capacity.

To us it appears that what is wanted is a controller of the supplies of materials. We now have a Light Alloy Committee, with Mr. F. S. Spriggs as chairman and with Brigadier-General Jones as Controller of Light Alloys. That is all to the good. But although the supply of light alloys is of great importance, the question of deciding who is to have which is even more so.

The Royal Air Force is not the only service which has calls upon the country's productive capacity. The Army and the Navy also want their share. That is a fact which, we think, is apt to be overlooked in aviation circles. "Priority" was something of a blessed word in the early days of the war. It now seems that there are various degrees of priority. Surely there should be one authority with powers to settle the rival claims of the three services in the light of the general war situation.

Good Work

NOW that it has, by the circumstances of the last couple of weeks, been given military objectives worthy of its skill, the Royal Air Force has more than lived up to our high expectations. Its work in bombing fuel depots at Hamburg and Bremen, in blocking the enemy's lines of communications, and in harassing his mobile forces in France and Belgium, has demonstrated not only the quality of our aeroplanes but the courage, skill and determination of the personnel of the R.A.F. The picture is by no means clear yet, but we have been permitted to see sufficient to realise that the contribution of the Royal Air Force may well be found to have been of vital importance to the present battle; and that is merely another way of saying that it may have a profound influence on the whole war, for it is becoming increasingly clear that ultimate success or failure is being decided in the struggle now going on. If Germany loses this battle she has lost the war, but, on the other hand, even if she wins the battle she is still a long way from having won ultimate victory.

Last week we commented on the fact that the transfer of the theatre of war to the Low Countries would have a marked influence on air strategy. Not only have our bombers shown their mettle, but the fighters have played their part, and right well they have played it. Repeatedly we have been told of Hurricane squadrons tackling German fighters which outnumbered them considerably, and it is particularly instructive to discover, what *Flight* had forecast some time ago, that the British single-engined fighters are more than a match for Germany's twin-engined Messerschmitt 110s.

Single or Twin?

IT is inevitable that the Hurricane successes should give rise to a revival of discussions concerning the relative merits of single-engined and twin-engined fighters. The issue is far from being a clear-cut one. The human element enters very prominently into the

argument. On the purely mechanical side, the twin-engined type may have an advantage in speed, due to the extra power. But it cannot be made as "clean" as the single-engined. Its moments of inertia must of necessity be greater, so that it cannot be as manœuvrable as the smaller machine. Whether it can be given armament which will make up by effective range and fire-power what it lacks in manœuvrability is open to debate.

From a production point of view, the single-engined type is far to be preferred, owing to its greater simplicity. Moreover, for every machine lost, one loses only one engine and one airscrew. At a time when our output may well be strained almost to breaking point, that is a consideration which cannot be altogether disregarded.

Hangar Doors

THE jamming of the door of the K.L.M. hangar at Schiphol aerodrome as the result of German bombing gives hangar designers one more requirement to bear in mind. It seems that one of the early bombs put the electrically operated mechanism of the doors out of action, and they could not be shifted.

As a result of this, the Allies are deprived of the use of several very good aeroplanes. To guard against such another happening and to provide, for peacetime conditions, a means of getting aircraft out of a burning hangar quickly, it is essential that an emergency means exists for opening the doors. The answer which immediately comes to mind, and perhaps the only answer, is to release the top of the doors so that they are free to fall outward. Over them the aircraft could then be towed to safety.

An essential condition that would have to be fulfilled in such a design would be that the door should in no circumstances fall inward, for obvious reasons, and the release mechanism must also be guarded against failing to function under bombing or fire conditions. The answer will call for some mechanical ingenuity on the part of the designers of hangar doors, and it may perhaps be found that such a device is easier to incorporate in one or other of the two main types, the sideways sliding or the type which rises into the roof.

Good-bye to All That

READERS will find on our Correspondence page this week a letter which they may consider somewhat out-of-date. So in fact it is, as it was written several weeks ago. But we have decided to publish it now because it is so absolutely typical of the hundreds of letters which we have received during the last few months. Young men who volunteered for the R.A.F. in the early days of the war, full of enthusiasm and burning with desire to serve their country, were beginning to wonder whether they had completely wasted their time.

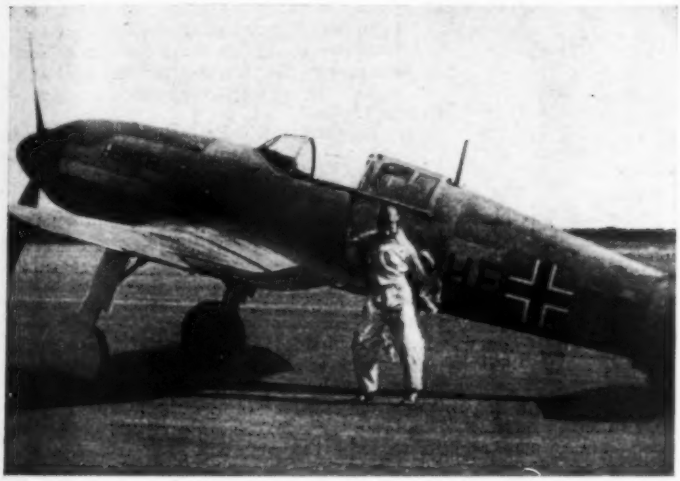
To them it seemed, not unnaturally, that "jerks" and "maths" had little enough to do with winning the war. We explained as best we could that the war had not developed as originally expected, and that when it did they would find that their time was not wasted after all. Now the Air Ministry is once more asking for volunteers, and the young men at the I.T.W.s will soon find themselves "doing the real thing."

Flight" Copyright Drawing

JAGDEINSITZER: The latest fighter to be issued to squadrons of the *Luftwaffe* is the Heinkel He 113. Some comments on this machine, which must have considerably less fire power and be less manœuvrable than our Spitfire and Hurricane, appear on the next page.

A NOT-SO-NEW HEINKEL

The He 113, Developed from the He 112



Although, as will be seen in the above view, the He 113 is a handy-looking machine, its manœuvrability may be severely handicapped by a high wing loading.

The picture on the left of an He 113 was first published in *Flight* of April 20, 1939.

PERIODICALLY the German propaganda machine is switched on to technicalities and churns out eulogies to new aircraft. Easily beguiled on these subjects, the British Press often attaches undue importance to the German outpourings; the latest instance of this concerns the Heinkel He 113 single-seater fighter. This machine was actually illustrated in *Flight* over a year ago—on April 20, 1939. At that time it was considered a development of the He 112 and was, in fact, stated by the Germans to be the He 112U which had just broken the world's speed record by attaining 463.9 m.p.h.

The design of the He 113 has been almost entirely revised in comparison with the original He 112 of 1937. The wings, although still of "inverted-gull" formation, are of different plan form, the sweeping curves of the original design having been abandoned in favour of a more severe trapezoidal shape. It will be remembered that the elliptical wing of the He 111 bomber was also superseded by a straight-edged type.

The undercarriage of the fighter now retracts inwardly, whereas in the original model the wheels, when raised, were housed in the outer wing panels. The fuselage and tail surfaces have been redesigned and the nose has been altered to take a Daimler-Benz DB 601 engine of the latest series. The radiator, which is apparently semi-retractable, is beneath the pilot's cockpit.

Details of armament are unknown, but a German source states that "light and heavy machine guns are carried." Although the hole in the spinner is not an infallible indication of the presence of a shell-gun mounted on the engine, a small protrusion from the mount of the hole would suggest that an engine-mounted gun is, in fact, installed. There is no evidence of gun ports in the leading edge of the wing outboard of the airscrew arc, but there are holes in the centre section close to the fuselage. Should guns be installed here the object may be to keep the weight centrally massed or to accommodate the magazines in the fuselage, where space is not so restricted.

The earlier He 112 with Daimler-Benz engine was claimed to do 354 m.p.h. at 14,760 ft. A higher degree of supercharging, greater power and cleaner design should have raised this considerably. The wing loading of the new machine may be more than the 31 lb./sq. ft. of the older type with DB engine, and, despite the fact that every effort has apparently been made to centralise the masses of the undercarriage, armament, and even wing markings, manœuvrability will undoubtedly be inferior to that of our Spitfire and Hurricane. Into the bargain, these machines carry a heavier armament load and should have a longer endurance. The first He 113 to be engaged came off second best to a Hurricane.

Whereas the most pronounced curve in the cowling of the Rolls-Royce Merlin is below the centre line, the reverse is true of the Daimler-Benz DB 601 installation.

THE LATEST ROTOL AIRSCREW

"External Cylinder" Constant-speed Type : Wooden Blades : 35 Degree Pitch Range

Fig. 1. The Rotol airscrew seen without its spinner.

A NEW airscrew, specially designed for the fast single-engined fighters of the Royal Air Force, but which can, of course, be applied for civil purposes, is now in production at the factory of Rotol Airscrews, Ltd., and is also in service with the squadrons. The Rotol firm, which claims the parentage of the Rolls-Royce and Bristol organisations, has for some time been making constant-speed airscrews of not only British construction, but design. This original type, with a pitch range of 20 deg. and known as the "internal cylinder" airscrew because the pitch-changing cylinder is enclosed within the hub, was fully described on page 296 of *Flight* of March 23, 1939.

Constant speed airscrews are automatically controlled by a constant speed governor-pump unit which is itself set by the pilot to govern the engine at any predetermined speed. Thus the pilot has a choice of engine r.p.m. irrespective of engine boost. Each setting of the airscrew governor control will maintain a definite engine r.p.m., each setting of the throttle a definite boost pressure, and adjustment of these controls provides any desired combination of boost pressure and engine r.p.m. irrespective of the attitude or altitude of the aircraft.

In addition to improved general performance, aircraft fitted with constant-speed airscrews have this advantage. When engaged in aerobatics the pilot does not continually have to manipulate the throttle to prevent the engine from "over-revving," for the governor unit will automatically vary the airscrew pitch as the forward speed changes in order to keep the engine speed unchanged at whatever figure the pilot has set the control.

The new airscrew is an advance on the previous design in that it has a pitch range of 35 deg. which is required to give sufficient variation of pitch angle for the extremes of forward speed which occur between take-off and power diving on modern high speed aircraft. Though not a feathering airscrew, it can be easily adapted for feathering by fitting a feathering pump and a cylinder with longer stroke to give the increased pitch range then required. It is known as the "external cylinder" type of Rotol airscrew as the pitch-changing mechanism is outside the hub —in front of it—though of course it is covered by the spinner.

Basically, the constructional features and method of operation are the same as for the "internal cylinder" 20 deg. type, the mechanism being worked hydraulically by engine oil, controlled by a governor-pump unit with centrifugal governor, whose design, as described in our previous article, remains unchanged. The following description which refers to Fig. 3 will enable the main constructional features and the method of operation to be readily understood.

The airscrew hub (1) is formed in one piece from a steel forging and carries a central sleeve (2) which runs axially through the hub and embodies a circular flange near its rear end which is bolted to the rear face of the hub shell. The front end of the sleeve is also bolted to a flange on the hub shell. The internal bore of the sleeve is splined at (3) to suit the particular shaft to which the airscrew is to be fitted and is also provided with the usual coned seatings. The hub shell is formed with three short barrels threaded internally and into these the blade bearing housings (4) are screwed. Each blade is supported in its housing by a stack of four ball bearings, which together serve to carry the journal loads.

The three bearings (5) nearer the airscrew axis are so arranged that the inner races tend to contract on to the blade adaptor (7) when loaded by the centrifugal pull of the blade, while the outer races tend to expand against the steel housing. There is thus a tendency for increase of rotational speed to make the blade still tighter in its mounting. (The centrifugal pull of one blade at maximum r.p.m. is about 35 tons if of wood, something like the weight of four London buses. With magnesium alloy it is about 50 tons.)

The outer bearing (6) is used for preloading the other bearings of the stack so as to take up any initial slackness in the assembly. In the drawing a metal blade (8) is shown but wooden blades can be fitted by the use of a different design of adaptor, the bearings and bearing housing remaining the same.

To seal the joint against water and stop electrolytic action, a wedge-shaped sleeve of Tufnol (20) is fitted into the housing and secured by a locking ring and setscrew. Removal of this sleeve for maintenance is effected by means of a groove around its circumference which coincides with the position of the setscrew of the locking ring. After first slacking off the locking ring, the setscrew is replaced with a grease nipple and grease pressure applied to force the ring out.

Final balancing of the airscrew is accomplished by insertion or removal of balancing strips (9) retained in position by a cover secured to the top of each housing by studs. The bearings are lubricated with grease prior to assembly, escape of lubricant from the bearings being prevented by gland seals.

Pitch-changing Loads

The base of each blade adaptor (7) carries a plate (10) to which is secured the blade operating pin (11). The plate (10) serves to lock the bearing retaining nut (12) in position and also provides a vernier adjustment (to 0.2 deg.) for the operating pin. In this way, when the blades are all set to a given pitch, the operating pins are in similar positions with respect to their blades. (The load on each pin due to torqe on the blade may reach as high as 1 ton.)

The mechanism for altering the pitch of the blades is a

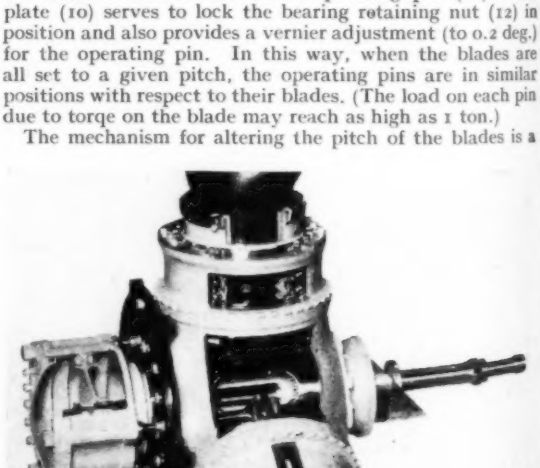


Fig. 2. Parts of the pitch-changing mechanism are visible in this sectioned hub.

double-acting hydraulic ram consisting essentially of a stationary piston (13) and a moving cylinder (14) mounted in front of the hub shell. Movement of the blades may require a total load of about 3 tons. The cylinder is connected to each of the blade-operating pins by a link (15) coupled to one end of a connecting rod (16) by a forked joint, the other end of the connecting rod being journalled on the operating pin by means of a suitable bearing. The relation of the cylinder to these links may be adjusted by the use of suitable shims (19) interposed between the shoulder on the link and the rear face of the cylinder. The forked joint forms a cross-head sliding in a tubular guide passing through and secured to the front face of the hub shell. The cylinder (14) has a long tube-like extension (17), which is arranged to slide freely within the hollow bore of the airscrew shaft. The central bore and the space between the double walls of the tube (18) serve to convey pressure oil from the governor-pump unit to the front and back of the piston respectively, and for this purpose an oil transfer (not shown on the drawing) is arranged inside the engine front cover to surround the airscrew shaft so as to feed oil to the airscrew.

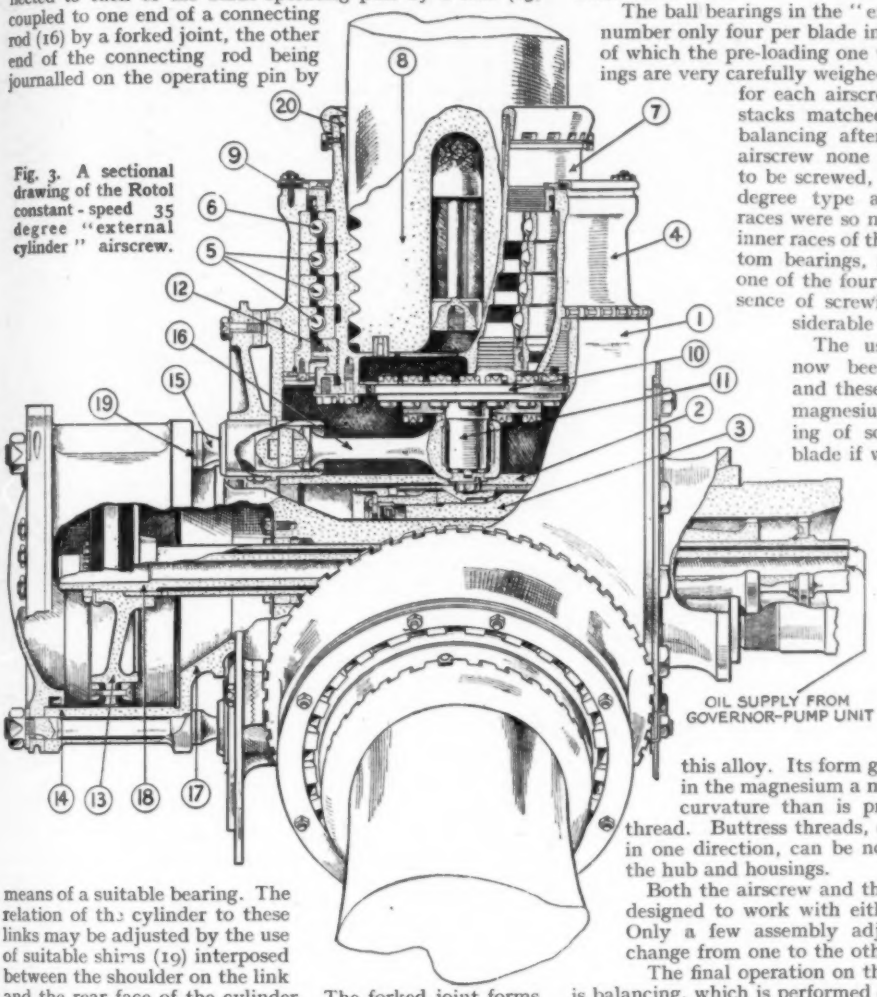


Fig. 3. A sectional drawing of the Rotol constant-speed 35 degree "external cylinder" airscrew.

A complete description of the working of the governor-pump unit was given in our previous article, and no changes have been found necessary after considerable use in service. The methods used in the production of airscrews were also described, and, as these are still in use, only new features or noteworthy points will be commented on in what follows.

The ball bearings in the "external cylinder" airscrew number only four per blade instead of the previous five, of which the pre-loading one was of smaller size. Bearings are very carefully weighed, and the twelve bearings for each airscrew are arranged in three stacks matched for weight to facilitate balancing after assembly. In the new airscrew none of the bearing races has to be screwed, as was the case in the 20 degree type airscrew, in which three races were so machined. These were the inner races of the pre-loading and the bottom bearings, and the outer of the top one of the four larger bearings. The absence of screwing is, of course, a considerable simplification.

The use of wooden blades has now been successfully mastered, and these may be fitted instead of magnesium alloy. There is a saving of something like 20 lb. per blade if wooden blades are used on a 1,000 h.p. airscrew. If wooden blades are fitted, a different type of steel adaptor with a wide-pitch thread of special form is used, and the wooden blade is screwed and cemented into this.

The thread used on the magnesium alloy blade is of interest as it has been specially evolved for use with this alloy. Its form gives the root of the thread in the magnesium a much more liberal radius of curvature than is provided in the usual V thread. Buttress threads, designed to take big loads in one direction, can be noticed in several places in the hub and housings.

Both the airscrew and the governor-pump unit are designed to work with either direction of rotation. Only a few assembly adjustments are needed to change from one to the other.

The final operation on the airscrew before delivery is balancing, which is performed on knife-edges in draught-free enclosures. Shims are added until a balance within the limit of 3 ounce-inches is obtained.

The governor-pump units are run under test and observed for oil pressure and correct functioning as their last factory process. It was demonstrated that the unit would move the oil valve and cause the airscrew pitch to change for an alteration in airscrew speed as small as 10 or 15 r.p.m.

C.S. airscrews have to-day become essential for fast aeroplanes, as an airscrew designed for maximum efficiency at top speed is hopelessly inefficient for take-off, the blades being stalled, or nearly so. Not only is the airscrew then aerodynamically inefficient, but it holds engine speed down and so reduces power.

Royal Singapore Flying Club

THE annual report of the Royal Singapore Flying Club for 1939 is a comprehensive and informative document as it analyses the club accounts into costs per flying hour as well as giving the usual total costs for various items. With a total membership of 322 (of whom 226 are non-flying or absent members), and 8 aeroplanes (6 Moths, 1 Magister and 1 Whitney Straight), the hours flown for the year amounted to 2,319, and 13,530 gallons of petrol were used, an average consumption of 5.8 g.p.h. There were no engine failures, which speaks well for the maintenance staff and the engines, all DH Gipsies. The number of "A" licences obtained was 25.

The balance sheet shows a loss of $7,000 but, in addition, $5,500 for aircraft depreciation was charged to the reserve account, so that the real loss for 1939 is $12,500, which approximates very closely to the reduction in Government subsidy. This amounted to $26,400 for 1939, while members' flying charges and subscriptions were $27,690 ($11.95 per hour). The average hourly charge for flying is very nearly $9, while petrol is about 72 cents per gallon.

Total cost per flying hour, including depreciation, is $29.68 per hour. With $1 equivalent to 2s. 3d. sterling, this is £3 7s. per hour. This cost subdivides into: petrol and oil, 15.4 per cent.; instructional staff, 14.1; ground staff, 30.2; maintenance material and spares, 13.4; depreciation of aircraft, 8.0; insurance, 2.0; hangar rent, 2.5; clubhouse and administration, 14.4.

HERE and THERE

Round the Clock

THE French Air Ministry has issued a communiqué to point out that all the French aircraft factories will in future work throughout the 24 hours, including Sundays and holidays.

Fitters Wanted

AN appeal was made recently by Lord Beaverbrook, Minister of Aircraft Production, for fitters working in garages, mostly on repairs of civilian motor transport, to volunteer for work in aircraft factories. Applications should be made either to the aircraft factories or to the nearest Labour Exchange.

Delivery of Boeing 307s

THE first of the Boeing 307 Stratoliners for T.W.A. was due for delivery at Portland, Oregon, early this month, to be followed almost immediately by two more. The first will be put on to the coast-to-coast route starting from Burbank, Cal., while the second and third will start their work from Kansas City, Missouri. Two more, making five in all, are due for delivery in June.

Incendiary Bombs

TESTS conducted at the Fire Brigade Headquarters, Sydney, show that it is more effective to handle incendiary bombs with shovels made of hardwood than of steel. Australian hardwoods were used in tests which consisted in igniting a quantity of thermite, the material of incendiary bombs, on wood and on steel. A hole was melted in the steel plate but the woods only charred, even though subjected to the fire for four minutes. The best species was a wood known as turpentine, which only charred to a depth of one-eighth inch, while bluegum and white cypress were found to be next best. Householders and fire authorities, in giving thought to their fire precautions to deal with this menace, would do well to remember this.

Northrop Builds Wind Tunnel

THE construction of a wind tunnel for testing models of new designs has been undertaken by Northrop Aircraft, Inc. Southern California aircraft manufacturers have been faced with crowded test schedules at the only two tunnels on the Pacific Coast, the Guggenheim Aeronautics Laboratory of the California Institute of Technology in Pasadena, and the University of Washington Aeronautics Laboratory at Seattle. The Cal. Tech. Tunnel required reservation three or four months in advance and the Seattle tunnel two months.

The Northrop tunnel will be the largest one owned by a manufacturer in the United States. Of the same size as the Cal. Tech tunnel, it was designed by the Northrop engineering department, assisted by Dr. Theodore Von Karman and Dr. William Sears. Of the return-flow type, it has a wind speed of 150 m.p.h. Power is supplied by a 450 h.p. internal combustion engine, which is a rather unusual feature. The tunnel is designed for much higher speeds by adding more power if required. The largest section of the tunnel is 35ft. by 22½ft., with the average size 22½ft. in diameter, narrowing to a 10ft. throat in which the model is suspended. Forces are measured on six Toledo scales, and the operator can lock these scales to get the readings all at one time if desired. Changes in pitch and yaw settings during the test run can be made without shutting down.

Modern Aircraft Valves

A VERY comprehensive paper under the title of "Modern Aircraft Valves" was recently delivered before the Boston and Hartford sections of the Society of Automotive Engineers by Mr. A. T. Colwell, who is a vice-president of Thompson Products, Inc., the well-known American valve manufacturing firm. The paper is an endeavour to collate all available present-day information on the subject of aircraft valves and is a very successful attempt. The author is in a fortunate position to write such a paper as his firm supplies valves to many famous aero-engine factories and the trend towards specialised part manufacture is very noticeable nowadays.

Covering some 23 typewritten sheets, the paper is copiously illustrated with 17 sheets of illustrations, and includes sections on design, manufacture and inspection, and operating troubles. The practices and technique employed by the leading engine firms of France, America, Britain, Germany and Italy are all included and the subject is dealt with in both the particular and the general way. For instance, we are told that: "The technique of valve Stelliting . . . requires close attention to details . . . A satisfactory flame is one in which the feather is three times the length of the inner cone." And elsewhere, "The use of sodium, the hollow head, and forced lubrication are American developments. Austenitic steel, Stellite and steel inserts were first employed in England."

With its operating temperatures of 1,100 to 1,300 deg. F., the exhaust valve is certainly one of the most wonderful parts of the modern aero engine and, as the author says, "Is meeting every requirement imposed upon it to-day. This includes speeds of over 3,000 r.p.m. and b.m.e.p. of over 200 lb./sq.in. Many American valves are operating over 5,000 hours." This paper is recommended to all interested in the design of aero-engines and is typical of the liberality with which Americans publish their technical data.

R.Ae.S., 1940

THE Royal Aeronautical Society announces the nomination of the following to the new council.

President: Mr. A. H. R. Fedden, M.B.E., D.Sc., M.I.A.E., M.I.Mech.E., M.S.A.E., F.R.Ae.S.; *Past President:* Mr. H. E. Wimperis, C.B., C.B.E., D.Eng., M.I.E.E., F.R.Ae.S.; *Vice-Presidents:* Mr. Griffith Brewer, Hon. F.R.Ae.S.; Air Vice-Marshall R. M. Hill, M.C., A.F.C., M.A., F.R.Ae.S.

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Alston Memorial Prize

THE Council of the Royal Aeronautical Society have accepted with great pleasure an offer from Mrs. G. Alston to found a prize in memory of her husband, Peter Alston, who was killed in a flying accident on February 16th, 1939.

The prize, an annual one of approximately £5 in value, will be known as the Alston Memorial Prize. It will be awarded by the Council of the Society for work aiming at the improvement of the safety of aircraft and particularly at improvement in stability and control and such award shall be made to the Student and/or Graduate of the Society who shall in any year be selected by the Council of the Society to be its recipient.

Martin Bombers Ordered

IT was announced by the Glenn Martin Company of Baltimore last Saturday that the Allied Purchasing Commission has accepted a specification for a bomber and has agreed to buy as many machines as the firm can turn out during the next eighteen months. The interesting statement is made that "the machine has been designed mainly by Allied aircraft experts schooled in the latest technique of air warfare."

Light Alloy Supplies

FOLLOWING the announcement, published in *Flight* last week, of the appointment of Brigadier-General H. A. Jones to the post of Controller of Light Alloys, the Ministry of Aircraft Production now announces that Mr. F. S. Spriggs has been appointed chairman of the Light Alloy Committee, the members of which are Mr. W. C. Devereux, Mr. F. S. Mitman, Mr. H. W. Clarke, and Mr. P. Pritchard.

THE AIR TRAINING SCHEME

Progress of Plan in Canada : Air Marshal Bishop Explains

THE first two Avro Anson twin-engined advanced training bombing planes were test flown at Toronto within a week of their arrival for assembly from Great Britain at the Toronto plant of the De Havilland Aircraft of Canada, Ltd., late in February. The plant engineers put the two bombers together, the first of 192 to come to Canada for assembly for immediate use by the British Commonwealth Air Training Plan, as it is now officially called. The remainder of the 1,622 Avro Ansons ordered by Canada from Great Britain for the scheme will come to Canada with fuselage and engines only, the wings and tail units to be made and the whole assembled in Canada.

Enormous orders have been given to the Canadian factories and work is being pushed ahead on these. Mr. Mackenzie King has just announced that the Finance Minister has been authorised to issue certificates up to about $180 million for equipment for training. The following are details of contracts for $83 million of this amount (figures are millions of dollars):—

	$
Canadian Associated Aircraft, Ltd., for Hampdens and Stirlings	37
National Steel Car Corporation, for Lysanders	7
Canadian Car and Foundry Co., Ltd., for Hurricanes	10
Fleet Aircraft of Canada, Ltd., for Fleet Trainers	3
De Havilland Aircraft of Canada, Ltd., for Tiger Moths	2
Noorduyn Aviation, Ltd., for Harvards ..	3
Irvin Air Chute, Ltd., for parachutes	1
Miscellaneous	20

Hangars are being constructed at the numerous aerodromes and four entirely self-contained Training Commands have been announced. The No. 1 headquarters are in Toronto, No. 2 in Winnipeg, No. 3 in Montreal, and No. 4, the farthest west, in Regina. Independent for maintenance and supply, each Command will have initial, elementary and service flying training schools as well as air observers, bombing and gunnery, navigation and wireless schools. Equipment and repair depots, air stores parks and, in one case, a school of aeronautical engineering, are also included.

Elementary Training

The organisation by which the R.C.A.F. pilots will be trained to solo stage has been announced by Mr. Howe, Minister of Transport. Sixty-seven schools will be established throughout Canada and the nuclei of these are the twenty-two flying clubs, which have contracted to train pilots and have already been doing so for the past year. Now private companies already operating as schools, and new companies, will be brought into the Plan to give this primary tuition.

It is understood that, under the contracts, successful bidding companies will have to lodge a $50,000 bond with the Department of National Defence, and will be given the necessary planes, equipment and buildings for training purposes. They will have to supply their own staffs of instructors and mechanics, and will have to turn out 48 pilots every month after fifty hours of primary flying instruction. The pilots, while taking the courses at these companies or flying clubs, will be under Air Force discipline. After graduating they will proceed to the R.C.A.F. schools for advanced flying.

Under the British Commonwealth Air Training Plan, the only method of entry to the Special Reserve of the Royal Canadian Air Force for elementary flying training will be through enlistment, according to announcements made by the Minister of National Defence. This is in accordance with the terms of an agreement signed last December by the Governments of the United Kingdom, Canada, Australia and New Zealand. No further applications for commissions in this category are being accepted.

Selection for the first courses will be made by the Air Force Headquarters, though this will be progressively decentralised until ultimately all selections for elementary flying training will be made by recruiting centres in accordance with quotas allotted. Following completion of an initial ground training course, candidates will be selected for further training, either as pilots, air observers or air gunners, the selection depending on the aptitude of the candidate. As far as possible, the expressed desire of the candidate will be given consideration.

All applicants who are accepted will be enlisted as aircraftmen, class II. On completion of their full training period those who have been selected for pilots will be entitled to the rank of sergeant. Those selected for air observers will be promoted to acting sergeant or to sergeant, while air gunners will be given the rank of leading aircraftman, aircraftman, class I, or aircraftman, class II, according to the percentage of marks obtained on passing out of training. A number of pilots and air observers passing out of training will be appointed to commissioned rank in the Royal Canadian Air Force. Those candidates found unsuitable for duties as members of an aircraft crew will be given the opportunity for remustering for general duties (ground), remustering to an air force trade (ground) for which they may be suitable, or of taking their discharge.

The Supervisory Board of the Plan consists of the Hon. Norman McL. Rogers, Minister of National Defence, chairman; Col. the Hon. J. L. Ralston, Minister of Finance; the Hon. C. D. Howe, Minister of Transport; Col. K. S. Maclachlan, Acting Deputy Minister of National Defence (Naval and Air); Air Vice-Marshal George M. Croil, Chief of the Air Staff; Sir Gerald Campbell, High Commissioner for the United Kingdom; Air Chief Marshal Sir Robert Brooke-Popham, Chief Air Liaison Officer of the United Kingdom Air Liaison Mission; and Keith Officer, of Washington, D.C. representing the Government of Australia. Also attending the meetings of the board are B. J. Roberts, Financial Adviser; Air Commodore G. O. Johnson, Member of the Air Council for Organisation and Training; and Commander C. P. Edwards, Chief of Air Services, Department of Transport.

Air Marshal Bishop's Address

To the news already given, the following extract is added from an address given by Honorary Air Marshal W. A. Bishop, V.C., D.S.O., M.C., D.F.C., who is the recently appointed Director of Recruiting for the plan. It describes the training which pilots will go through before their real work starts.

"A young man joining here in Toronto would, after being accepted, be sent to the Initial Training School in the old Eglinton Hunt Club and there receive a thorough grounding in discipline, and elementary instruction in

ground subjects, as well as some knowledge of the history and traditions of the Air Force. On completion of this course, he is selected for training either as a pilot, air observer or air gunner. The course lasts four weeks.

"His next move, if selected to be a pilot, is then to an Elementary Flying Training School. Here he has his first actual flying training, which includes instrument flying and elementary navigation as well as further instruction in ground subjects. He is here for a period of eight weeks, and in that time should get in fifty hours.

"These schools will be chiefly flying clubs, conducted by civilians, as this proves to be the most efficient method for this elementary training. The flying clubs have most excellent instructors throughout. In these schools the pupils fly for the most part Fleets and Tiger Moths. If, after fifty hours of flying, the R.C.A.F. inspector considers that any pupil is not likely to make a good pilot, then, naturally, this instruction will be discontinued, and the pupil may be enlisted in another category.

"If, on the other hand, he is accepted as a good pilot prospect, the pupil's next step is to a Service Flying Training School, which at the moment, in this district, is Camp Borden, where he will do a further fifty hours of flying at an intermediate squadron on service type single-engine and twin-engine machines, such as Harvards and Ansons. During this period a great deal of time is spent on instrument flying, air navigation and night flying, and on successful completion of this course he is awarded his pilot's wings.

Advanced Training

"The next step is what we call advanced training in the advanced squadron of the same Service Flying Training School, and the purpose of this training is to prepare pilots for employment in fighter, bomber, and army co-operation squadrons. The syllabus now becomes much more complicated, and of course much more interesting. It includes night flying, bombing, air gunnery, navigation, reconnaissance, and photography, and the ground subjects appropriate to the type of unit for which the pilots are being trained. In this school it is planned to give the pilots an additional fifty hours flying, thus bringing their total flying time to approximately 150 hours.

"So after 150 hours of training the recruit is sent overseas to join a Group Pool as a fighter or bomber pilot. The only exception is in regard to certain special cases that are chosen for army co-operation work who receive further training such as at the moment we are carrying on at Ottawa.

"One hundred and fifty hours of flying is a great deal. But when these pilots go abroad they will receive further training in a Group Pool prior to being posted to squadrons on active service. It is anticipated that it will be possible to give each pilot at least fifty hours more flying before being posted, thus bringing his total to about 200 hours before being called upon to take part in active service operations.

"In the last war the average flying time of a pilot who reported to a squadron in France was twenty-five hours, some, in the earlier stages of the war, having as little as ten to fifteen hours to their credit. I know in my own case I was night flying at the mouth of the Thames, with only fifteen hours' flying, looking for Zepps, which, thank God, never came my way! My senior officer, who was the only other person on this duty with me, was a real flying veteran—he had at least forty hours' solo to his credit. In fact, my total flying time at the end of the war was only, roughly, 400 hours, and my case was exactly the same as the other pilots.

"It is obvious, therefore, that these boys, with 200 hours' flying experience before they go into battle, will be well and perfectly trained. No stone is being left unturned to see that our Air Force is superior to any enemy.

"I have been talking only about the pilot who proceeds overseas, but what so many people are inclined to forget is that this war is closer to home than the last war. Our front already lies at our coastlines. Many of our pilots are serving in war conditions on our two coasts to-day, particularly, of course, our Atlantic coast. The convoys that you hear of constantly leaving successfully, and arriving successfully, are in danger from the second they leave port. The Royal Canadian Air Force, in co-operation with the Royal Navy and Royal Canadian Navy, is carrying out a magnificent job in escorting these ships far out to sea.

"This flying is of the most hazardous type. It requires great skill and precision. The weather conditions are the worst. Suffice it to say that these operations have been carried out without a hitch. Many of our pilots have gone to this work—home defence. But, in this war, home defence is apt at any moment to mean direct contact with the enemy.

"As regards the air observers' training and the air gunners' training: the air observer, after finishing his first course of four weeks at the Initial Training School, goes to an air observers' school for a course of twelve weeks, where he is given full instruction in navigation, reconnaissance, and photography, including, roughly, thirty hours' flying. And the same applies to the other categories.

"I have now described to you what happens to the young man who joins up, hoping to be selected for commissioned rank in the Force. The second category I mentioned is that of the man who, being proficient in a trade, and particularly in wireless or mechanics, or with good clerical experience, applies to enlist. In his case he must have either suitable educational qualifications or special technical training. When he applies he is trade-tested by a very capable staff who test him for rigger, fitter, signals, clerk, metal worker, and so on. If successful in passing these tests he then goes to a Recruit Depot, where he is outfitted in his uniform, given lectures and a certain amount of drill.

Enormous Numbers

"After this, which is not a long time, if his mechanical qualifications justify it, he is sent directly to a squadron or a technical training centre. If his tests or examinations call for further technical training, in this particular district just now, he would be sent to St. Thomas, where we have some seven hundred aircraftmen who will, as soon as they qualify, be posted to the various stations.

"As an example of another type of man needed, at Guelph they have started a cooking school for chefs in the R.C.A.F. Sixteen chefs from Trenton, Camp Borden and St. Thomas are there at the moment being trained in food values and calories and how to plan meals.

"You can see, Gentlemen, from what I have just said that at the moment we are very much employed in instructing and training instructors and trainers, who will in their turn be responsible for the education of all pupils who will be enrolled in this air training project. This is very necessary because of the gigantic proportions of the scheme which, at its peak, will be turning out some 7,000 pilots, and 12,000 air observers, air gunners and other trained personnel each year. And in addition to this there will be a home establishment entirely apart from the pupils themselves, which will possibly exceed 33,000."

Topics of the Day

THE TIME HAS COME

"Indicator" Has More to Say About Control Layouts and About a Perhaps Distant Future

ONE day, I feel, the manufacturers would do well to call a meeting of test and ferry pilots so that the whole question of the standardisation of a convenient control layout may be thrashed out.

Nowadays the word "standardisation" is rather more important than "convenience," since the majority of modern types have, through the efforts and criticism of works test pilots and others, become reasonably rational. Furthermore, though it is occasionally necessary to carry out a sort of fast sleight of hand trick with undercarriage, throttle and airscrew controls immediately after the take-off, one becomes accustomed to anything, and a pilot who habitually flies one particular type will probably refuse to hear a word against the layout which has become second nature to him.

But for ferry pilots, at any rate, the infinite variations and combinations can be a very present source of trouble, and a standardisation scheme would be worth while from the production costs point of view.

There are, of course, one or two standard control boxes, but these, though excellent in themselves, can cause more trouble even than scattered Heath Robinson arrangements when the various manufacturers decide that the different levers shall have very different purposes. It is comparatively easy to remember that the Excraft fighter has its undercarriage and flap selector on the right and the airscrew control above the throttle on the left, that the Whycraft long-range bomber has the whole lot in one place, or that the Zedcraft medium bomber has the pitch controls behind the undercarriage control on the right and below and the petrol cocks almost out of reach on the right.

Conducive to Confusion

Those are sufficiently different to be easily remembered. The real difficulty arises when exactly similar or similarly placed controls have totally different functions. For instance, there are two types in which exactly the same control box and layout is used, with the controls reading in rows from left to right and from front to rear respectively (and as far as I remember) as follows: (a) Throttles and mixture controls; supercharger, carburettor heater and constant speed airscrew controls; cut-outs; balance cock and main petrol cocks. (b) Constant speed airscrew and throttle controls; petrol cocks and cut-outs combined, supercharger control and mixture lever; carburettor heater control.

Admittedly, the majority of these controls need only to be looked at and handled before leaving the ground, but in the air and at critical moments it might be possible to move airscrew controls instead of throttles, mixture levers instead of airscrew controls, supercharger controls instead of carburettor heater controls, and petrol cocks instead of supercharger controls. The ferry pilot expects to be caught out and is therefore ready to readjust his mind to each type, but imagine the effect on a pilot who is thoroughly accustomed to one type only and placed, without warning or time for preliminary ground practice, in the control cabin of the second type. To quote a few examples, it is equally disastrous to attempt to take off with the blower control in its high-speed position, with the airscrew controls in full course, and with the mixture controls in "weak."

These things *could* happen, though, for instance, the mixture controls cannot usually be moved with the throttles in the closed position or will spring back as soon as they are opened. The uninitiated might imagine that an even better take off and climb (though with deleterious effects on the power units) can be obtained by using the high-altitude blower speed. In fact, at ground level atmospheric pressures, the power taken by the supercharger when turning at high speed, is a good deal greater than that obtained through the higher effective compression ratio. The majority of the latter must also and necessarily be lost through preignition and so forth. Things, in fact, are not at all what they seem.

Automaticity

It might almost be possible and reasonable to go to the extreme of arranging all essential controls so that they move to the correct take-off position as soon as the throttles are opened. Such a system would demand a cut-out so that the principle would not be applied when running-up on test, when making an approach or when using full throttle in level flight. A large indicator could be used to show the pilot whether the machine was "in automatic" or not.

When the throttles were opened with "automatic" in action, the hydraulics would be turned on, the trimming tabs properly adjusted, the mixture moved to rich, the pitch control adjusted to "fine" and the flaps to "up" or take-off position. A stop on the throttle would prevent it from being moved with the petrol cocks off or the indicator lights out. Such a scheme may sound complicated but it is no more so than anything else, and much less expensive than one broken aeroplane.

While on the subject of standardisation—and remembering that there will, eventually, be a peace—it should be possible to design bomber and long-range reconnaissance types so that they can, without ruining their essential military features, be converted to carry passengers and/or mail. That, I feel, is something worth trying in the case, particularly, of really large types. On no account must development be delayed, but an additional section of any design staff can be working on the problems involved while the machine is still in the drawing-board stage. If these "conversion" experts are late with their modifications, then, of course, the design must go through as a purely military type.

Defence and offence requirements make compromise absolutely impossible in sizes which are at present used. I am thinking more of the sometimes maligned "flying fortress" type of thing. Such items as turrets, dustbins, bomb traps and long-range tanks do not require such basic planning as size increases. That, at least, is how it appears to the semi-technical and partially informed insider.

No doubt certain sections of the lay Press would, if they saw such a suggestion in print, accuse me of having dealings with this strange, new and largely mythical thing known as the Fifth Column. It would not be difficult to show that I was attempting to sabotage produc-

Topics of the Day (Continued)

tion by introducing new difficulties and I should promptly be classed with the conscientious pacifists and other harmless and well-meaning sections of the Great Inside Enemy. During the last war, encouraged by a savage armchair section of the community, quite excellent people were trampled upon and had their shop windows smashed just because their names were vaguely Germanic in origin. A little more of this Fifth Column stuff and the same thing will be happening again. Even if there *is* a war on, let us endeavour to retain a certain degree of sanity and civilisation. We are fighting to preserve just those things which the busybodies are endeavouring to stamp out.

Private Smith, strange as it may seem, is risking his life so that Mr. Brown can continue to possess the legal right to say that war is absurd and wrong or that the system which permits it is wrong—and to say it publicly, in print or in Hyde Park. Therein lies the difference between the Totalitarian and Democratic principles.

INDICATOR.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

WAITING AND WONDERING

Air Gunners and "Maths"

READING your issue of *Flight*, dated March 14, on which I congratulate you, I came to the Air Estimates, which in turn brings me to the subject of this letter.

Five months ago I was on top of the world, I had been accepted as a photographer in the R.A.F. When I passed my "medical" the officer told me to go home and wait, but he did not think that I would have to wait long. Now I am beginning to wonder, with despair in my heart, whether I shall *ever* realise my ambition to join the only Service that I really care for. After all, five months seem like years when you're waiting.

Sir Kingsley Wood has stated that he is keeping a pool of accepted men to be used when desired; what happens if these men are never required? Are they to be kept out of the other Services by the faint hope that they will be needed by the Service for which they have volunteered?

Another question that I have put to a few men in the R.A.F., without much satisfaction in their replies, I'm afraid, is, why should an A.G. be required to have a knowledge of "Trig." and "Logs"? Perhaps someone "in the know" will enlighten me on this point. It seems that the passport to a flying job is the school certificate. If this is the case, let me remind the "Powers that be" that a man can acquit himself without a school certificate just as well as the individual armed with one.

In conclusion, I might state that I am not only writing this letter for myself, but to try to help the hundreds of other young men who want to join the R.A.F., but might never have a chance if something is not done about it.

Brentwood. W. S. P.

ACCELERATED OUTPUT

A Suggestion for Voluntary Aid

REALISING that a rapidly accelerating output of aircraft parts, accessories and all subsidiary equipment is urgently required, I put forward the following suggestion to your readers.

It is based on the theory that, assuming firms to be working to present capacity, there is no hope of additional output without further expansion, involving more buildings, more machinery and more trained labour. But additional expansion is possible if employees will put in voluntary additional time to that which they are now working.

The basis of the scheme is this: Direct subscription from the company concerned, or other voluntary subscriptions in cash, would provide the necessary material. The employees of that factory would then volunteer to work one or more hours extra on any evening, Saturday afternoon or maybe Sunday, intimating to their employers that under this scheme their services and time would be given to their country free of charge.

This would mean that the country would receive a stream of goods at no cost for materials or labour, and these goods would be completely additional to those which are now being produced.

It must be made clear that it is not strictly necessary for the time to be spent on any specific article or articles, so long as they are all urgently required, provided time to a certain value is put in. Putting it in its simplest form, if a company produce say, £110 by subscriptions to purchase materials, and the aircraft parts concerned involve 2,000 hours of work, the moment 2,000 voluntary hours have been put in by the workers on their existing jobs, the components could be presented to the country free of charge.

It will be seen after a moment's thought that we should rapidly produce, by these means, squadrons or parts of aeroplanes which would not otherwise be obtainable in the same time.

I have put this suggestion forward to the staff at my two main factories purely to receive their reaction. Their verdict, and the response, have been remarkably good. I therefore put this forward to you in the hope that you will see fit to publish it, or point out to me any insuperable difficulties you may see in it. Difficulties are certain to arise but these could, no doubt, be overcome.

Even if the scheme is not taken up by all manufacturers concerned, the effort of those who do take it up would make it well worth while. If the response to the suggestion is a good one, it would not be difficult for a voluntary central organisation to co-ordinate the efforts of the firms working under this voluntary scheme.

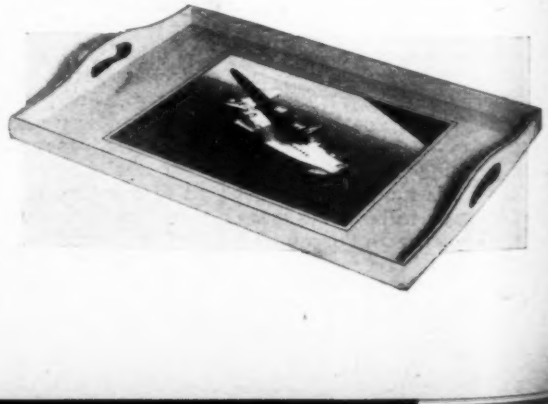
The above is purely an outline of the scheme and further details could be furnished if necessary.

Vokes, Limited. C. G. VOKES, Managing Director.

Cocktail Trays

FOR some time past there have been on the market cocktail trays illustrated with coloured pictures of aircraft and covered with glass. A new style is now available in which the sides have been made higher and a special lacquer used in place of the glass. This lacquer is both heatproof and waterproof and gives an excellent finish. The trays are in the R.A.F. colours, the main colour being pale blue with dark blue and red lining. The whole of the base is covered in green baize.

Flight photographs form the basis of the illustrations; therefore, almost any tvpe of British aircraft can be supplied. Measuring 19¾in. by 13¼in., the cost is 35s. 6d., and they are to be had from any big store or direct from M. Owen Jones, Ltd., 1, Talgarth Mansions, Barons Court, London, W.14. Smaller trays measuring 18in. by 11in. are available at 27s. 6d. and table mats to match may be had if required.

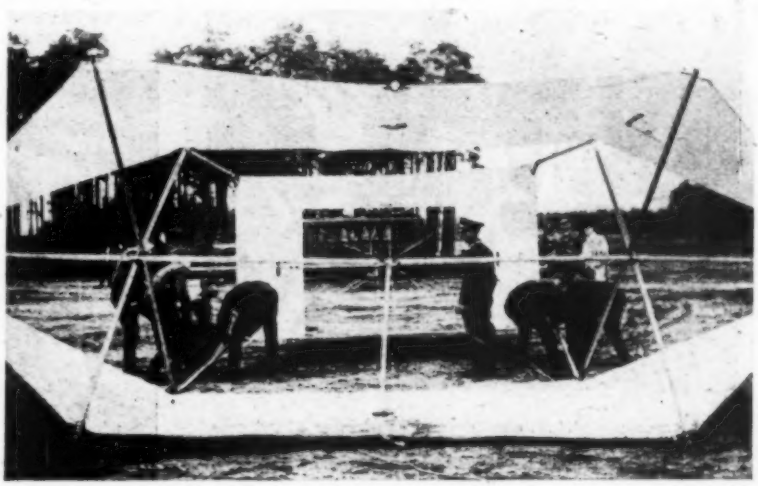


WAR in the AIR

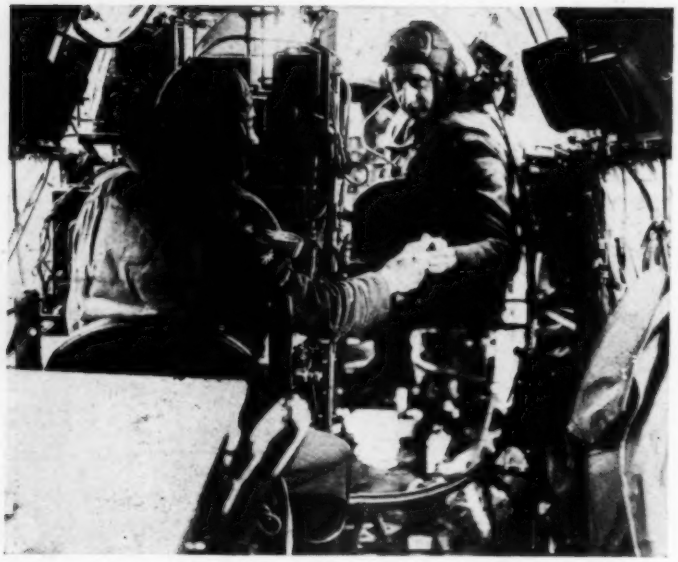
Pressure Increases on the Belgian-French Frontier : Terrific Air Activity

An oblique photograph taken by the R.A.F. of the demolished bridges over the Albert Canal at Maastricht.

THE intense effort by the Germans to effect a breakthrough on the Belgian and French defence lines has continued for the past week with unabated vigour. Having regard to the fierceness of the battle, comparatively little artillery is being used by the enemy. His striking force consists mostly of mechanical vehicles of one type or another supported by A.A. guns of all calibres and used in conjunction with hordes of low-flying and dive-bombing aircraft. The method employed is to use such overwhelming weight of pressure at a selected point that a small gap is made. Tanks and other motorised units are poured through this gap, spreading out fanwise to take the adjacent defence in the rear and cause confusion to the local command. Meanwhile aircraft bomb and machine-gun any attempts at closing the gap. It is on this counter-attack work that our Hurricanes have put in such devastating work with their eight-gun batteries. Vastly superior formations, often accompanied by protecting fighters—either Me 109s or Me 110s—have been attacked with astounding dash and resolution, and frequently destroyed or so broken up as to prevent them from carrying out their mission. The Battles and Blenheims of the B.A.F.F., also in face of serious odds, have bombed and machine-gunned enemy transports, bridge-heads, junctions, tanks in action, and any other of the thousand and one targets which present themselves in an encounter of this magnitude. It is, of course, obvious that the losses on both sides must be very heavy, and even to guess at the numbers of aircraft involved or destroyed would be fatuous. Nevertheless, it does appear that, owing largely to the striking power of our fighters, the enemy losses are at least three times as heavy as ours.



For protection against low bombing or dive bombing the Germans use a number of large kites to protect vital targets. The kites serve the same purpose as a balloon barrage.



The longest ever. Members of the New Zealand squadron of the Royal Air Force in the Vickers Wellington which completed a long-distance reconnaissance covering the whole Norwegian coast.

WAR IN THE AIR (CONTINUED)

The nights being moonlit, Bomber Command Wellingtons, Whitleys and Hampdens have been able to select military targets in approach areas east and west of the river Rhine. On the night of Wednesday, May 15, the Royal Air Force made the biggest air attack of the war on these communications, with, it is believed, excellent results. Again, we have the strange fact that very little air opposition was met, although anti-aircraft firing was very severe. Does this mean that the Me 110 is no more docile than the 109? Certainly, the new Heinkel He 113 hardly appears to be designed for night flying.

At the time of writing, so far as can be gathered from very scanty reports, the Front extends roughly from the river Scheldt, near Antwerp, along the river Dendre west of Brussels, through Landrecies and Guise to Montmedy. The direction of the attack has wheeled north-west.

The most serious break-through occurred near Sedan on Wednesday, May 15, when German mechanised units penetrated the French defences. Violent counter attacks by the French appear to have slowed down the advance.

Very cheering. R.A.F. casualties and a member of Princess Mary's R.A.F. Nursing Service find the Royal Air Force issue of *Flight* amusing. It was not quite meant that way.

After losing the whole of their air force and some 25 per cent. of their total ground effectives, the Dutch troops were ordered to cease fire on May 14 to save unnecessary loss of life. As a final comment on the occupation of Holland, it may be said that treachery on the part of the "Fifth Column" and landings by parachute and air-transported troops at Waalhaven and The Hague were mostly responsible. The Dutch did, however, hold a large number of German troops at bay for a very precious period during which the British and French were able to advance into the Low Countries. At some future date this may be looked upon to have affected the whole course of the war.

An account can now be given of how the Boulton Paul Defiant acquitted itself in its first taste of battle. As already announced by the Air Ministry, the first encounter lasted only five minutes from the moment when a German Ju 88 was sighted out to sea trying to bomb three British ships until it—the Ju 88—crashed in a field south of The Hague. A squadron of the new Fighter Command Defiants—the first fighters to be equipped with a power-controlled gun-turret—had been keeping watch round The Hague for some time when the Junkers was sighted. The Squadron Leader engaged it, together with two other of his Defiants, as it turned towards the coast.

First Blood

FINDING himself cut off by the three British fighters, the Junkers dived, but the Squadron Leader outmanœuvred him and saw his air gunner score hits. The Junkers flew low over three fields with smoke pouring from his port engine, with the Defiant still in pursuit. Finally, the Junkers crashed in a field full of cows grazing.

The Defiant, it will be remembered, is a two-seater fighter in which the air gunner has a power-operated four-gun turret just aft of the pilot's cockpit. It is the modern equivalent of the old Bristol Fighter which did such excellent work in the last war. The "Brisfit" had a 275 h.p. Rolls engine and one Lewis gun in the gunner's cockpit firing at the rate of 700 rounds per minute. The Defiant has 1,100 horse-power and four Browning guns each capable

A close go. It was lucky for the French pilot of this Curtiss that he was leaning forward when this bullet arrived. Note the armour plate at the back of the seat.

WAR IN THE AIR (CONTINUED)

Clearing for action. A French Morane 406 being prepared by ground staff. The machine guns in the wings and the shell gun firing through the airscrew boss can be clearly seen.

of 1,200 rounds per minute. On the night of May 17 the oil depots and other important military targets at Bremen, Hamburg, and as far south as Sedan, were subjected to a terrific hammering by heavy bombers of the Bomber Command, the attack in some cases lasting over five hours. At Bremen a direct hit on a petrol storage tank caused a fire the flames of which reached 2,000ft., and another oil fire started at Hamburg was so large that it could clearly be seen from as far away as Cuxhaven.

Air War in Brief

On Saturday and Sunday, May 11 and 12, forty-five enemy machines were known to have been destroyed.

* * *

A Pilot Officer flying a Spitfire shot down a Junkers Ju. 87 dive bomber and afterwards found he had joined a formation of Me. 109s instead of his own flight. He escaped in a cloud.

* * *

In one encounter, three Hurricane pilots attacked thirty enemy bombers and their fighter escorts. One Me. 110 and one He. 111 were shot down. In this fight a Hurricane pilot forced another He. 111 to crash land. He then landed beside the enemy aircraft and took the crew prisoner.

* * *

At Dinant, a road bridge over the Meuse was seen to collapse after being hit and fires were started on the east bank of the river. Immediately west of Givet a railway line was hit and the Beauraing-Givet road bombed.

* * *

In the raids on German oil stores and railways parachute flares have been used to identify the targets. Parachute flares can be as intense as six million candle-power and photographs have been secured by the light of them.

* * *

Whitley, Wellington and Hampden heavy bombers have all been used for the night raids on Hamburg, Bremen, Cologne and Hanover.

* * *

May 16 was a Hurricane day. A formation of six attacked a formation of 25 Messerschmitt Me. 110s and shot down five. Two Hurricanes intercepted nine Me. 110s and bagged four. Other encounters during the day brought the total up to fifty.

* * *

During the first eight days of the invasion of the Low Countries the Air Ministry estimated the enemy losses to be over 1,000 machines. The Germans claim to have brought down 1,462.

* * *

A Pilot Officer and his crew who were shot down during a raid over Holland managed to make a dash for the Hook of Holland and crossed to England on the destroyer which carried Queen Wilhelmina and the Dutch Government.

* * *

During an offensive patrol over Belgium on Saturday last a flight of Hurricanes shot down three He 111s over Brussels and severely handled three more. One of the pilots described the action as a general mêlée over a distance of 40 to 50 miles. The Heinkels, originally twelve in number, were on their way home from a raid.

* * *

Another fighter patrol, this time consisting of 11 Hurricanes, took on 17 Messerschmitt 110s and shot down six of them with no loss to themselves.

* * *

A passenger steamer carrying 800 refugees to England from the Continent engaged two German aircraft which attempted to bomb and machine gun it. With their anti-aircraft gun they brought one down in flames.

* * *

Describing the A.A. barrage to which they were subjected during their raid on Hamburg the pilot of one of the machines said: "It seemed to be just one continual stream that might have been coming from several hundred hose-pipes. We could see the barrage breaking all round us, but we managed to keep a straight course at the right moment and to drop our bombs with accuracy."

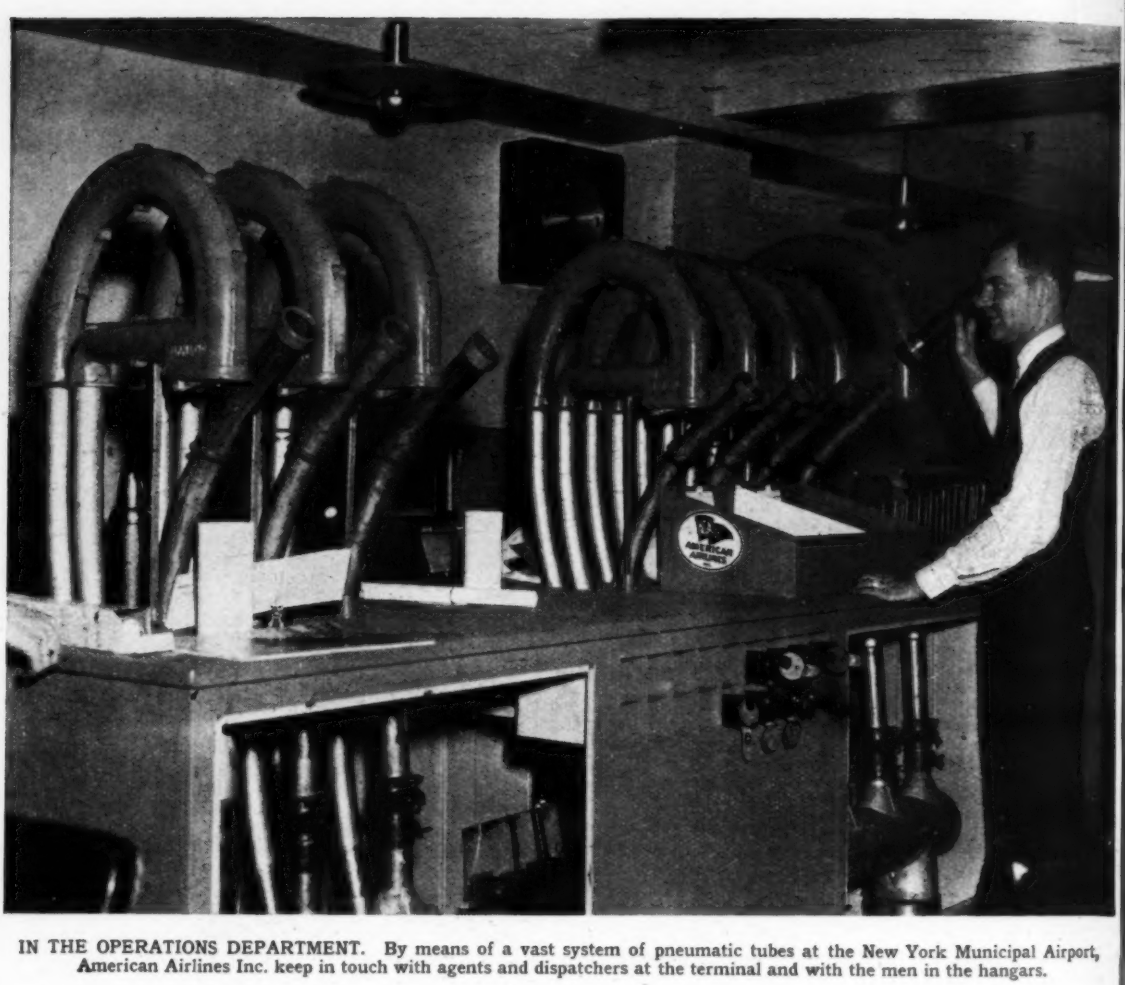
* * *

Another pilot flying a later machine appeared to be more fortunate. "Most of the gunfire kept away from us," he said, "and so did the searchlights. I think the ground crews were too busy attending to other aircraft to have any time for us. By the light of the moon we were able to get a clear view of our target. We did a run-up, took our time about it, dropped our bombs and came home unmolested."

* * *

The crew of a Hampden, finding their target already on fire, circled round for nearly five minutes in order, as the pilot put it, "to be quite sure that we had arrived at the right address." Satisfied of his position, he launched his attack and saw a number of small fires break out and soon develop into one immense blaze.

Two of a sort. A Flight Lieutenant and a Sergeant Pilot who both brought down four enemy machines each on the first day of the invasion of the Low Countries.



IN THE OPERATIONS DEPARTMENT. By means of a vast system of pneumatic tubes at the New York Municipal Airport, American Airlines Inc. keep in touch with agents and dispatchers at the terminal and with the men in the hangars.

CIVIL AVIATION NEWS

Air Mail to Low Countries

THE Postmaster-General announces temporary suspension of the mail services, including air mails, and the money order and telephone services to Holland, Belgium and Luxemburg.

Flight-checking Officers in Australia

FLIGHT-CHECKING officers are to be appointed at principal civil aerodromes in Australia to plot the progress of aircraft in transit on the air routes and generally to assist pilots in regard to meteorology and navigation by means of radio. They will receive position reports, direct aircraft to alternative aerodromes when necessary and control arrival times at airports. Appointments will be made at the four capital city airports of Melbourne, Sydney, Brisbane and Adelaide, at salaries of £A502, rising to £A574, per annum. Applicants are required to have considerable flying experience and a knowledge of air navigation.

Changes for Civil Aeronautics Authority

HARD on the heels of Plan III, President Roosevelt has announced Plan IV, which places the Civil Aeronautics Authority back under the control of the Department of Commerce. This is just two years after the Authority was brought into being and commercial aviation was thereby removed from the Department's sphere. It is reported that aviation men are stunned by the scheme, which so far is only a proposal and can be disapproved by Congress in 60 days. Part of the scheme is to bring the Weather Bureau into the Department of Commerce, and the abolition of the Air Safety Board is also proposed.

Plan III was a change within the structure of the Authority whereby the five-member Board was relieved of administrative duties which were handed over to the Administrator. *American Aviation* makes the comment that: "Back of the President's proposal is believed to be a plan for a single transportation unit, and the proposed shift of the C.A.A. is one step in this direction."

Scottish Air Services Resumed

AGAIN the Hebrides are brought within a few hours' distance of Glasgow by the resumption of a thrice-weekly air service on May 14. Similar fast transport facilities between Clydeside and Stornoway began the following day. Renfrew Airport is beginning to acquire some of its pre-war briskness as daily services to Belfast and Liverpool are again running. Air liners are now calling twice daily at Campbeltown and Islay.

Wartime traffic is heavier than peacetime. D.H. Rapides are now exclusively in use by Scottish Airways, as all the Spartan Cruisers were requisitioned soon after the outbreak of war. Prospective passengers for districts north of Islay are reminded that they must have permits to enter these prohibited areas.

Private Flying on the Rand

IN spite of the fact that the majority of flying done at the moment is military, private flying is still going on at the Witwatersrand Technical College Flying School, the Union Aviation Company and the Rand Flying Club at Germiston and at Grand Central Aerodrome on the Pretoria Road.

European Air Services

THE speed of events in the war zone in the last fortnight makes it impossible for a weekly paper to announce each change to its readers before another change occurs, but suffice it to say that though some services have ceased many others are still running. Among these are the British Overseas Airways Empire route and the service to Paris. K.L.M. and Sabena services are, of course, out of action to England, though K.L.M. continues to Batavia. One of the bombs dropped on Schiphol Aerodrome jammed the hangar doors and many of the aircraft were imprisoned and lost to the enemy. Others were immediately flown to England. Six of the Sabena fleet were flown away from Brussels Airport after bombing started, and reached England. Air France Transatlantique has been granted permission by the Civil Aeronautics Authority to make experimental flights till November 1 between France and the United States, but considering the gravity of the situation, it seems doubtful whether France will be able to take advantage of this. A bad accident occurred on May 16 at Barcelona when the Italian airliner on the Rome-Madrid route crashed in take-off and killed nine people.

American Export Airlines appear likely to be on the Atlantic soon, as the report of the C.A.A. examiner recommends that they be allowed to run a service between New York and Rome via Lisbon and Barcelona for the transport of passengers, mail and freight. The application was strongly opposed by Pan American, but to no effect. American Export's applications for routes to England, the Irish Free State and France were dismissed without prejudice owing to the state of hostilities existing.

Indianisation of Air Services

IN every air organisation in India a large majority of the personnel now consists of Indians. The Indianisation of the Tata aviation organisation has been progressively increased. Of a total of 14 pilots, 13 are Indians and the wireless operators are all Indians. Forty-seven engineers and mechanics out of 51 are Indians and of the administrative staff 38 out of 40 are Indians.

The personnel of Air Services of India, Ltd., is 100 per cent. Indian. The Indian personnel of the Directorate of Civil Aviation in India is 94.1, of Imperial Airways, Ltd., and Indian Trans-Continental Airways, Ltd., 82.9, of Indian National Airways, Ltd., 94.5, of Tata Sons, Ltd., 95.5, of Indian Air Survey and Transport, Ltd., 90.9, of subsidised Flying Clubs in British India 92.8, and of Indian States Flying Clubs 89.6 per cent.

It is indeed good to hear that Indians are taking an increasingly important part in the running of the air services in their own country and it is consistent with the rise of India towards full Dominion status. But we hope that appointments will always be awarded to those who can serve air transport best, irrespective of colour, race or religion. Only by such an attitude will air transport be able to give its best in the service of the world, and it may well be that it will be the greatest single mechanical force working towards the restoration of international peace when this present war has reached its end.

News from India

THE flying clubs in India are luckier than clubs in the countries which are nearer the centre of hostilities as they have been able to keep going actively, and the Bombay Flying Club is able to report a total of 335 hours flown for the month of March, which is 142 hours greater than for March of last year. Five new members commenced training for their "A" licences during the month and 11 members have been approved by the Director of Civil Aviation for inclusion in the Civil Aviation Reserve Training Scheme. Cross-country flights, competitions and night flying are all going strongly.

The Hyderabad State Aero Club at Begampet, though it has only a small membership of 84 logged 61 hours for February, and Miss Bookless obtained her "A" licence, being the first European lady member to do so. The U.P. Flying Club at Cawnpore flew 42 hours for February, and the Bengal Flying Club reports a record total with 318 hours for March. The total membership is 270. Eighteen cross-country flights were done, which is particularly good seeing that the club has only four aeroplanes, with an additional four maintained by the staff for private owners.

There is a total of 151 landing grounds of all types in India. This includes civil and military, government and privately owned. Of these, twenty-three are now open for public use by passenger-carrying aircraft.

A "smoke trail" wind indicator is being installed at Juhu aerodrome, Bombay, as the latest of the experiments made by the Civil Aviation Department to determine the most satisfactory form of wind indicator for use under Indian conditions.

Installed in the centre of the aerodrome, flush with the surface, the "smoke trail" wind indicator burns oil on an electrically heated plate and discharges a plume of dense white smoke. A method of illuminating the smoke to provide wind indication by night is being investigated.

An illuminated wind sleeve consisting of a fabric cone of conventional type illuminated from above for night flying is giving effective results in trials at Karachi and will probably be installed at other aerodromes which have been lit for night flying. An illuminated wind indicator formed of plastic material and lighted internally has also been tried out, but is less sensitive than a wind sleeve.

Geography from the Air

NINETEEN girl students of Frances Shimer Junior College at Mt. Carroll, Illinois, spent their Easter holidays as a flying geography class, visiting New York, Washington and Annapolis, in an American Airlines transport. Happenings like this will become commoner in the future if full advantage is taken of the aeroplane's capacity to supplement classroom education.

Australian Aerial Medical Services

THE annual report of the Australian Aerial Medical Services dated December, 1939, shows that the fabric of the "mantle of safety," which was the dream of the Rev. John Flynn ("Flynn of the Inland") has now been completed and covers the whole of outback Australia. It was due to Flynn, then in the Australian Inland Mission, that the first aerial medical base was established, with the aid of Qantas, at Cloncurry, in Queensland, in the nineteen-twenties. Since then other bases have been set up and each provided with its aeroplane, doctor and radio station. To call up the base and ask for medical aid when needed, outlying cattle and sheep stations are provided with "pedal" radio sets, so called because the power is provided by pedalling on a mechanism improvised in the first place out of the sprocket and chain of a bicycle. Commercial telegrams can be sent over these channels and the charge made helps towards the revenue of the service. Some of the base and outpost stations also send weather reports to the Commonwealth Meteorological Bureau.

There are now six bases in all, the other five being at Broken Hill (N.S.W.), Wyndham (W.A.), Alice Springs (N.T.), Kalgoorlie (W.A.), and Port Hedland (W.A.), and these are all run by the Australian Aerial Medical Services, a non-profit making company which derives its income from donations and a Government grant, which has lately been increased from £5,000 to £7,500. The Australian Inland Mission has handed over its base to the A.A.M.S. but will retain connection with it by the nomination of an associate councillor.

Considering the nature of the service rendered in a continent which is about 2,500 miles across, the costs shown in the accompanying figures for maintenance are quite low:—

	Actual 1936/7	Actual 1937/8	Estimated 1938/9	Estimated 1939/'40
Cloncurry	£5,229	£6,530	£5,615	£7,230
Wyndham	2,030	2,698	2,620	2,940
Port Hedland	2,302	3,130	3,765	3,940
Broken Hill	798	3,839	5,100	4,915
Kalgoorlie	—	881	1,865	2,280
Alice Springs	—	—	—	2,220
	£10,359	£17,078	£18,965	£23,525

These figures include radio operators' salaries as well as all flying costs. All the bases are equipped with De Havilland Dragons, twin-engined aeroplanes being very desirable over some of the country.

The next set of figures shows the use which is being made of the medical and telegraph services:—

	12 Months to 30/6/1939		6 Months to 31/12/1939	
	Mileage	Telegrams	Mileage	Telegrams
Cloncurry ...	51,436	19,269	22,442	8,562
Wyndham ...	11,144	6,213	4,465	4,247
Port Hedland ...	5,691 (7 mths.)	7,245	2,516	3,082
Kalgoorlie ...	9,040	2,279	2,605	2,009
Broken Hill ...	16,975	2,548	7,454	2,848
Alice Springs...	—	—	6,018 (4 mths.)	209 (1 mth.)
	94,286	37,554	45,500	20,957

The Alice Springs base is the latest to be established and E. J. Connellan is pilot there to the Government Medical Officer. There are two other flying doctors in Australia, not under the A.A.M.S. One is at Ceduna (S.A.), piloted by Alan Chadwick and run by the Bush Church Aid, and the other is Dr. Clyde Fenton at Darwin, who is an official of the Department of the Interior.

SERVICE AVIATION

"Flight" photograph.

Royal Air Force and Official Announcements

A GREAT FIGHTER: It is related on another page how nine Hawker Hurricane eight-gun fighters accounted for ten out of twenty Ju 87 dive-bombers. The success of the Hurricane is due not only to its heavy fire power but to its extreme manœuvrability.

The King Visits Bombers

LAST Saturday the King paid a visit to the Bomber Command and studied maps and reports dealing with recent operations. He afterwards sent the following message to the R.A.F.:—

"During my visit to the headquarters of the Bomber Command to-day I was able to hear more about the epic deeds of our bomber forces in recent weeks. Coupled with the arduous and unceasing duties of the Coastal Command and with the heroic exploits of our fighter squadrons in this country and in France they make an immortal story—a story that fills the whole Empire, whose sons are now fighting in all three branches, with gratitude and admiration.

"I congratulate the Royal Air Force with all my heart, and wish them good luck and continued success. The matchless spirit that has shown so clear an ascendancy over the enemy makes the final victory of the Allies doubly sure.—GEORGE R.I."

Air Crews Wanted

THE Air Ministry has announced that men are wanted to form a pool from which air crews can be drawn.

Men are wanted between the ages of 18 and 28 for training as pilots and between 18 and 32 as observers and wireless operator/air gunners. Application should be made to the nearest recruiting centre, but applicants should not give up employment until accepted.

Air Awards

THE KING has been pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED FLYING CROSS.

TIMMERMAN, ACTING FLIGHT LIEUTENANT NELLES WOODS.

During May this officer was pilot of an aircraft returning to its base, when an enemy aircraft was seen to fly past in the opposite direction. Flt. Lt.

MARINE MAJESTY: A fine impression of the lines and size of a Saunders Roe Lerwick long-range flying boat. Fitted with two Bristol Hercules sleeve-valve engines the Lerwick is outstandingly fast for a marine aircraft. Powered gun turrets are installed in the extreme bow and stern and on top of the hull.

ADVANCED FORMATION : Miles Master advanced trainers (Rolls-Royce Kestrel XXX) in a commendable vic formation. The Master reproduces many of the characteristics of such machines as the Hurricane and Spitfire and with a more powerful engine would make a very useful first-line fighter.

Timmerman immediately turned and gave chase, and, after firing from his front gun with great determination, shot the enemy down into the sea. In April he successfully attacked two enemy patrol vessels, destroying at least one of them. This officer has displayed great resource, determination and enthusiasm in carrying out special night operations, often under adverse weather conditions.

WARNER, FLYING OFFICER GERALD BERNARD.

As captain and pilot of his aircraft this officer displayed exceptional skill and courage when attacked by a superior number of enemy aircraft. He successfully manœuvred his aircraft, to afford the most effective use of the guns, and thus enabled his gunners to beat off the attack and destroy one Messerschmitt 109. Another Messerschmitt 110 was severely damaged. F/O. Warner has at all times shown exceptional skill and coolness in face of the enemy.

HILL, PILOT OFFICER ROBERT JAMES.

During April P/O. Hill was the captain of one of six aircraft which had been sent to attack enemy transports and shipping in Granvin Fjord. While returning to his base, after completing his task, he encountered two Dornier 18 flying-boats, which he immediately attacked. One Dornier alighted on the sea, and P/O. Hill resumed the attack with his front gun, several bursts being seen to hit the fuselage. While he was continuing this attack the second Dornier attacked his aircraft but was beaten off, and it eventually dived at the water, where its bows submerged. During this last phase P/O. Hill was wounded in the face and hand, but throughout the engagement he displayed great courage and initiative.

ORTON, FLYING OFFICER NEWELL.

During March this officer was the leader of a rear section in a patrol of nine aircraft, and in that position was allotted the important task of guarding the rear of the formation. While two enemy aircraft were being pursued into Germany he noticed other enemy aircraft at the left rear. After warning the leader of the formation, he proceeded with his section to attack the enemy, which proved to be three Messerschmitt 109s, one of which he shot down in flames. Later, during the same patrol, the formation again came into action with 12 enemy aircraft, and during this engagement F/O. Orton attacked a Messerschmitt 110 and, it is believed, destroyed it. This officer has displayed skill and determination in a number of previous combats.

CRAVEN, ACTING FLIGHT LIEUTENANT ROBERT EDWARD.

This officer was captain and pilot of a flying-boat which proceeded on a special journey to Norway in very bad weather in April. On arrival at his destination he handled his aircraft with great skill and gallantry and disembarked his passengers in the face of persistent enemy bombing attacks. The return journey was successfully accomplished on the following day in spite of adverse weather conditions. Flt. Lt. Craven displayed great determination, courage and perseverance in carrying out this hazardous mission.

JONES, PILOT OFFICER LAWRENCE LATHAM.

This officer was second pilot and navigator of a flying-boat engaged on a special journey to Norway in April. During the temporary absence of his captain, after a landing had been made, P/O. Jones assumed command and successfully manœuvred his aircraft on the water to avoid the intense bombing attacks by enemy aircraft. Subsequently it became necessary to take off, but he was attacked by an enemy fighter shortly afterwards. By skilful tactics he brought his tail guns to bear and the enemy was shot down.

GOOD, ACTING SQUADRON LEADER DUNCAN CHARLES FREDERICK.
GARDINER, PILOT OFFICER WALTER GEORGE.

Sqn. Ldr. Good and P/O. Gardiner were respectively pilot and navigator of an aircraft engaged on special night reconnaissance early in May. When flying low over the objective, the aircraft was subjected to heavy anti-aircraft fire, one shell bursting in the pilot's cockpit, wounding Sqn. Ldr. Good and damaging the controls and instruments. Although severely wounded, the pilot completed his reconnaissance, manœuvring his aircraft to avoid searchlights and anti-aircraft fire, but then collapsed from loss of blood. In the darkness, with the aircraft at a low altitude and still in the danger zone, P/O. Gardiner succeeded in extricating the wounded pilot from the cockpit. He brought the damaged aircraft back across 450 miles of sea, making a perfect landfall and landing under difficult and harassing conditions.

The King has been pleased to approve the following awards for gallantry and devotion to duty in the execution of air operations:—

DISTINGUISHED FLYING CROSS.

SUTCLIFFE, SQUADRON LEADER WALTER PHILIP.
WHITWORTH, SQUADRON LEADER JOHN NICHOLAS HAWORTH.
BICKFORD, ACTING FLIGHT LIEUTENANT RICHARD.
PHILLIPS, ACTING FLIGHT LIEUTENANT ALLAN SMITH.
TOMLIN, ACTING FLIGHT LIEUTENANT BRIAN STIRLING.
LINGS, FLYING OFFICER GEORGE OLDFIELD.
RAPHAEL, FLYING OFFICER GORDON LEARMOUTH.

DISTINGUISHED FLYING MEDAL.

BRINN, SERGEANT WILLIAM GEORGE.
McARTHUR, SERGEANT WILLIAM CORDIL.
WYNESS, SERGEANT ROBERT FRANCIS.
RICHARDS, CORPORAL ALAN GLYNDER.

These officers and N.C.O.s have made a large number of reconnaissance and bombing raids over enemy country and over enemy air and naval bases. One officer, compelled to land owing to shortage of petrol after a flight over Warsaw, found he was in Germany. Despite the smallness of the field and petrol shortage he managed to take off again and save both aircraft and crew. Another officer pressed home a low bombing attack

ORDERS : The Flight Operations Officer of a fighter squadron in his portable office.

Service Aviation

on the German cruiser Admiral Scheer in Schillig Roads last September. One of the N.C.O.s obtained a direct hit on a submarine in Heligoland Bight. Two others did valuable work in attacks on enemy submarines.
WATERFALL, AIRCRAFTMAN 1ST CLASS JOHN HENRY (631726).
This airman was the rear gunner of an aircraft attacked by a superior number of enemy fighters, but by cool, deliberate and accurate fire he shot down one Messerschmitt 109 in flames and severely damaged one Messerschmitt 110. His actions were undoubtedly instrumental in securing the safe return of his aircraft to its base.

Fleet Awards

THE King has been pleased to approve the following awards for daring and resource in the conduct of hazardous and successful operations by the Fleet Air Arm against the enemy, especially on the coast of Norway:—

DISTINGUISHED SERVICE ORDER
PARTRIDGE, CAPTAIN RICHARD THOMAS, Royal Marines.
LUCY, LIEUTENANT WILLIAM PAULET, Royal Navy.

DISTINGUISHED SERVICE CROSS
HARE, LIEUTENANT-COMMANDER GEOFFREY, Royal Navy.
TORIN, LIEUTENANT HARRY ERNEST RICHARD, Royal Navy.
HANSON, LIEUTENANT MICHAEL CHARLES EDWARD, Royal Navy.
TAYLOUR, ACTING LIEUTENANT EDWARD WINCHESTER TOLLEMACHE, Royal Navy.
McKEE, MIDSHIPMAN (A.) THOMAS ANTHONY

DISTINGUISHED SERVICE CROSS (BAR)
TAYLOUR, ACTING LIEUTENANT EDWARD WINCHESTER TOLLEMACHE, Royal Navy.

DISTINGUISHED SERVICE MEDAL
MONK, PETTY OFFICER AIRMAN HAROLD ARTHUR, FX.76290.
CUNNINGHAM, ACTING PETTY OFFICER AIRMAN HOWARD GRESLEY, FX.76292.

MENTIONS IN DESPATCHES
Lt. Cdr. Aubrey St. John Edwards, Royal Navy; Lt. William Paulet Lucy, Royal Navy; Lt. Michael Charles Edward Hanson, Royal Navy; Lt. Robert Southey Bostock, Royal Navy; Lt. Cecil Howard Filmer, Royal Navy; Lt. Kenneth Vyvyan Vincent Spurway, Royal Navy; Acting Lt. Edward Winchester Tollemache Taylour, Royal Navy; Acting Petty Officer Airman Howard Gresley Cunningham, FX.76292; Petty Officer Airman Christopher James Edwin Cotterill, F.55040; Naval Airman First Class Frederick Percival Dooley, FX.79169; Leading Airman Maurice Hall, FX.76325.

THRICE HONOURED
An unusual distinction falls to Acting Lt. E. W. T. Taylour, of the Fleet Air Arm, who has been mentioned three times in the above awards for gallantry. He is awarded the D.S.C., a bar to the D.S.C., and is mentioned in despatches.

Casualties

THE Air Ministry regrets to announce the following casualties on various dates:—

KILLED IN ACTION.—F/O. E. J. T. Clarke (39375); Sgt. W. R. Coveney (580764); P/O. J. E. A. Friend (40818); Sgt. C. Frost (580650); F/O. C. W. Glover (39659); A/C. 1st Class J. B. Greenall (547006); P/O. R. Hall (43151); P/O. J. Marshman (77039); L.A/C. E. Townend (535545); Sqn. Ldr. R. H. Watson (90059).

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "KILLED IN ACTION."—A.Flt. Lt. J. E. Baskerville (37537); Flt. Sgt. D. W. G. Nichols (561600); Sgt. G. H. Stiles (580407).

WOUNDED OR INJURED IN ACTION.—L.A/C. J. J. K. S. Fisher (546704); P/O. R. T. Kean (41295); A/C. 2nd Class P. R. Leigh (637407); Sgt. V. H. Linthune (523023); Sgt. T. B. G. Pyne (565921); A/C. 1st Class P. D. Salmon (551589).

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. J. M. Gilmer (41690).

MISSING.—Flt. Sgt. R. Abbott (590429); Sgt. F. J. R. Beavis (563045); Sgt. K. Bell (565626); F/O. J. R. Birch (39430); L.A/C. W. E. Brewster (546678); F/O. A. A. T. Bulloch (33224); Sgt. L. A. Compton (565482); Cpl. P. H. D. Ditmas (550777); Sgt. G. C. Durie (580510); Sgt. W. Eddleston (524172); L.A/C. J. Ellwood (533022); F/O. G. V. Gordon (39080); L.A/C. A. W. Hallam (534748); P/O. R. G. M. Harmston (41845); P/O. A. H. Hayter (41289); Sgt. C. R. Heayes (562741); Sgt. W. T. Howells (562745); Sgt. H. Jackson (528709); Sgt. G. Kelly (522560); P/O. T. Kerr (70863); L.A/C. S. Lane (528628); P/O. R. O. Lawty (41301); Cpl. J. C. McIntyre (522777); A/C. 1st Class K. C. Merrick (624355); P/O. J. D. Murphy (36177); Sgt. H. A. Peel (527531); P/O. M. C. Petrie (40425); Sgt. W. Priestley (564931); L.A/C. R. A. Roberts (540263); A/C. 1st Class D. Robertson (633753); L.A/C. J. Rosemond (533258); A/C. 2nd Class W. A. Seymour (629671); Sgt. L. F. Tomlinson (580338); L.A/C. E. L. Weeks (550895); L.A/C. G. Welsh (617385); L.A/C. P. Wilson (514613); A/C. 1st Class N. A. Young (627971).

KILLED ON ACTIVE SERVICE.—P/O. G. O. Arscott (41145); Sgt. G. R. Barford (660547); Sgt. F. J. Bass (580902); Sqn. Ldr. W. J. F. Bell (32042); A/C. 1st Class H. Buttery (650521); A/C. 2nd Class E. Cooper (580093); Temporary Cpl. G. G. Cumming (519733); L.A/C. J. F. Dobson (568825); A/C 2nd Class P. W. Froom (619761); P/O. K. N. Gray, D.F.C. (40342); A/C. 1st Class A. W. H. Hart (632176); L.A/C. R. Holt (570723); Sgt. J. H. Hopper (518878); P/O. R. G. Kennedy (42409); Sgt. R. M. Mainland (566418); Sgt. G. B. Sprange (754740); Sgt. B. O. Whitely (741588); P/O. D. Wood (75016).

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. J. A. Anderson (535829); P/O. R. E. Atkinson (41242); Sgt. A. E. Hall (742283); A/C. 2nd Class G. Main (632772).

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. A. F. B. Ramsay (42379).

DIED ON ACTIVE SERVICE.—P/O. G. H. Bennett (18242); P/O. C. A. Chope (90826); A/C. 2nd Class H. W. Dilgert (770519); A/C. 2nd Class R. Holloway (944357); A/C. 2nd Class S. L. Holmes (636274); A/C. 2nd Class J. B. Legge (653737); A/C. 2nd Class L. R. Lock (649315); A/C. 1st Class W. D. Moses (624924); A/C. 2nd Class D. L. G. Neal (746364); A/C. 2nd Class W. Pounder (987670); A/C. 1st Class S. Pratt (547499); A/C. 2nd Class A. W. Weatherill (940080).

KILLED IN ACTION.—L.A/C. H. Eaguley; P/O. K. J. Drabble; Sgt. D. G. B. Falconer; Sgt. G. B. Irvine; L.A/C. P. J. Lamble; F/O. P. H. Rayner; Sgt. T. D. Smith.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. J. A. L. Barter; Sgt. J. C. Carpenter; A/C. 2nd Class G. Everson; A.Flt. Lt. P. W. B. Kite; F/O. A. F. Lemaistre; A/C. 1st Class G. H. Maile; A/C. 1st Class R. L. Miller; L.A/C. F. A. Morrison; L.A/C. D. W. B. Upham.

WOUNDED OR INJURED IN ACTION.—L.A/C. R. W. McCarthy; P/O. A. F. M. Wilson; Sgt. A. Young.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. J. Anning; Sgt. D. I. Anthony; L.A/C. T. H. Bowen; Sgt. H. F. Bullock; Cpl. G. H. Dixon; Flt. Lt. A. C. Heath; P/O. T. Hurst; L.A/C. O. A. Hutchinson; A.Flt. Lt. B. R. Kerridge; Sgt. C. H. Lowne; Sgt. S. A. Nicholls; Sgt. C. J. S. Poole; L.A/C. C. R. Wells; F/O. M. C. Wells.

MISSING.—P/O. M. H. Anderson; F/O. T. G. Bessett; A/C. 2nd Class R. W. Bence; P/O. A. H. Benson; Sgt. J. T. Boxen; Sqn. Ldr. R. L. Bradford; L.A/C. H. Bridson; Sgt. J. R. Brooker; L.A/C. E. W. Burnett; F/O. R. M. Burns; P/O. J. L. G. Butterworth; L.A/C. W. T. Cavanagh; L.A/C. C. C. Child; Sgt. J. Christie; F/O. C. A. R. Crews; L.A/C. R. D. Davies; Sgt. T. W. Davis; A/C. 2nd Class M. J. Delahunty; A/C. 1st Class A. Ellis; L.A/C. T. S. Evans; Sgt. K. D. Footner; F/O. D. E. Garland; L.A/C. H. T. Garbett; A/C. 1st Class B. Gill; P/O. I. L. Gray; Sgt. F. W. Gregory; P/O. G. F. Harding; Sgt. T. C. R. Harrison; L.A/C. H. C. Hawkins; P/O. A. P. B. Hordern; F/O. A. J. Hudson; P/O. C. P. de L. Hulton-Harrop; Cpl. G. Hurford; Cpl. L. D. Isaacs; Sgt. C. M. Jennings; Sgt. N. S. D. Jones; Sgt. J. B. Keegan; Sgt. B. E. S. Knowles; Flt. Lt. A. W. Lee; Sgt. E. E. B. Le Voi; Sgt. J. A. A. Luck; P/O. D. J. T. Lusk; L.A/C. W. A. McFadden; Sgt. R. I. L. MacKenzie; F/O. A. McPherson, D.F.C.; Sgt. A. A. Maderson; Sgt. F. Marland; P/O. A. W. Matthews; A/C. 1st Class D. Mevrick; Sgt. N. C. Middlemass; A/C. 1st Class S. W. Mills; F/O. C. R. Moore; Sgt. M. Moore; P/O. J. D. Morrison; L.A/C. J. D. Openshaw; L.A/C. H. F. Over; F/O. A. D. Panton, D.F.C.; A.Flt. Lt. E. Parker; Sgt. M. G. A. Pearce; L.A/C. J. L. Perrin; L.A/C. L. R. Reynolds; F/O. A. C. Roberts; Cpl. R. K. Rye; Sgt. J. C. Sands; P/O. N. A. Savill; A.Sqn. Ldr. W. I. Scott; L.A/C. J. C. Senior; Sgt. K. N. Shrosbree; F/O. G. W. Slee; L.A/C. R. Sloan; Sgt. V. Spurr; Sgt. H. R. Sunderland; Sgt. I. L. Thomas; Sgt. N. H. Thompson; Sqn. Ldr. G. C. Tomlinson; L.A/C. R. R. H. Townsend-Coles; L.A/C. P. A. Tyler; L.A/C. R. H. Tyler; Sgt. E. H. Ward; Sgt. J. Whalley; A/C. 2nd Class R. A. Wood; F/O. S. P. Woollatt.

KILLED ON ACTIVE SERVICE.—Sgt. V. Allison; P/O. J. T. Berryman; A/C. 2nd Class R. F. J. Bowie; Sgt. H. I. Child; Sgt. N. F. F. Giddings; L.A/C. C. J. Goddard; Sgt. P. R. Lutley; L.A/C. C. V. C. E. Neirynck; P/O. G. Polglase; P/O. L. O. Rogers; A.Sgt. E. O. F. Schmid.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. G. W. Acock; P/O. E. R. M. Appleton; Flt. Lt. V. A. Dawson; A.Sqn. Ldr. G. H. Sheenan; F/O. A. H. H. Tollemache.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. L. Evans.

DIED ON ACTIVE SERVICE.—Aircraftwoman 2nd Class S. U. Carpenter; Cpl. J. E. Hally; Cpl. L. F. Hayes; A/C. 1st Class K. Howlle; Sgt. I. J. McKay; A/C. 2nd Class F. E. C. Purvis; A/C. 1st Class A. Quincey; A/C. 1st Class F. G. Settle; A/C. 2nd Class N. F. Southgate.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. V. H. Barr; A/C. 1st Class F. Repteeaves.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED PRISONER OF WAR.—F/O. M. W. Donaldson; P/O. F. D. Middleton.

CURVED BULLET-PROOF GLASS

A USEFUL contribution to the safety of our aircraft crews is being made by British Indestructo Glass, Ltd., who have recently opened a new section of their works. The manager of this new section is Mr. R. H. Moon, who has for several years been working on improvements in plastic fittings for aircraft, and is now able to put some of the fruits of his research into production.

Among the important innovations that have been introduced by British Indestructo Glass, Ltd., is a single-curvature laminated safety glass, which is bullet-resisting and is composed of several laminations of glass and acetate interlayer. This glass can be made up to 1½in. in thickness. Double-curvature laminated safety glass in thinner gauges is also produced, and in both cases British Indestructo Glass, Ltd., have done the pioneering and development work in this important field of military aircraft production.

Definite Advancement

The effect of these improvements can easily be seen when we remember that the only form of bullet-resisting glass which has so far been produced is flat. Various synthetics have been extensively used for double-curvature surfaces, but they have inherent disadvantages which can now be overcome by the use of glass. The outcome of the manufacture of these various types of curved glass now in production is that the same shapes and transparency may be used, with additional strength and durability.

We believe we are correct in stating that this is the first time that it has been possible to manufacture the 1½in. bullet-resisting and double-curvature safety glass in this country. In some instances aircraft manufacturers have purchased ordinary curved glass in the U.S.A.

Seeing it Through

AN indication of the importance attached to X-ray testing of materials in the non-ferrous and welding industries is to be found in the news that Commercial X-Rays, Ltd.—a pioneer concern—have found it necessary to open a branch complete with laboratories at Birmingham.

Industrial applications of X-rays have advanced so rapidly in recent times that some difficulties have arisen in delivering the test pieces to the main works in West London. It is the intention of Commercial X-Rays, Ltd., to establish branches in all the principal centres of industry, but the Midlands, as the home of the non-ferrous industry, naturally has first claim. The new laboratories and offices are at 53, Wentworth Road, Harborne, Birmingham, 17.